

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

PILOT STUDY OF VEGETATION IN THE ALCHICHICA-PEROTE
REGION BY REMOTE SENSING

M. Soto, F. Lozano, A. Diez, C. Mejia, J. Villa

(NASA-TM-75101) PILOT STUDY OF VEGETATION
IN THE ALCHICHICA-PEROTE REGION BY REMOTE
SENSING (National Aeronautics and Space
Administration) 20 p HC A02/MF A01 CSCI 08F

N78-24596

Unclass
20784

G3/43

Translation of "Estudio Piloto de la Vegetación en
la Región de Alchichica-Perote por medio de la Per-
ception Remota", Instituto de Investigaciones Sobre
Recursos Bioticos, Flora de Veracruz, Contribution
#24, (Biotica, Vol. 2, No. 3, 1977, pp. 19-36)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546 June, 1978

1. Report No. NASA TM 75101		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Pilot Study of Vegetation in the Alchichica-Perote Region by Remote Sensing				5. Report Date June, 1978	
				6. Performing Organization Code	
7. Author(s) M. Soto, F. Lozano, A. Diez, C. Mejia, J. Villa				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address SCITRAN Box 5456 Santa Barbara, CA 93108				11. Contract or Grant No. NASW-2791	
				13. Type of Report and Period Covered Translation	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546				14. Sponsoring Agency Code	
15. Supplementary Notes Translation of "Estudio Piloto de la Vegetación en la Región de Alchichica-Perote por medio de la Percepción Remota", Instituto de Investigaciones Sobre Recursos Bioticos, Flora de Veracruz, Contribución #24, (Biotica, Vol. 2, No. 3, 1977, pp. 19-36)					
16. Abstract A study of the application of satellite images to the identification of vegetation in a small area corresponding to the arid zone of Veracruz and part of Puebla is presented. This study is accomplished by means of images from the Landsat satellite obtained on January 19 and May 23, 1973. The interpretation of the different maps is made on the basis of information from the data bank of the Flora de Veracruz program, and various surveys made by land and air. ORIGINAL PAGE IS OF POOR QUALITY					
17. Key Words (Selected by Author(s))			18. Distribution Statement Unclassified - Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 21	22.		

PILOT STUDY OF VEGETATION IN THE ALCHICHICA-PEROTE REGION
BY REMOTE SENSING¹

/19*

M. Soto², F. Lozano³, A. Diez⁴, C. Mejia⁴, J. Villa⁴

ABSTRACT

A study of the application of satellite images to the identification of vegetation in a small area corresponding to the arid zone of Veracruz and part of Puebla is presented. This study is accomplished by means of images from the Landsat satellite obtained on January 19th and May 23rd, 1973.

The information is processed by means of the SIADIS computer program, from the Department of Hydraulic Resources (SRH). Preclassified gray maps are obtained. These maps are the basis for identifying areas covered by different types of vegetation, according to the classification by Miranda and Hernandez (1963), such as "izotales", bushes, juniper and stonepine forests, cultivated areas, etc. A description is made of each one of the various types of vegetation in the zone.

The interpretation of the different maps is made on the basis of information from the data bank of the Flora de Veracruz Program, and various surveys made by land and air.

INTRODUCTION

One of the problems to solve in the Flora de Veracruz program has been that of obtaining vegetation maps which accurately reflect the present state of the vegetal layer. Vegetation maps at the "vegetal

¹Flora de Veracruz, Contribution No. 24 of the Research Institute of Biotic Resources, A.C., the Biology Institute, UNAM, and the Chicago Field Museum of Natural History, to perform an ecological-floral study of Veracruz State, Mexico.

²Biology Institute, UNAM (National Autonomous University, Mexico).

³Research Institute of Biotic Resources.

⁴Remote Perception Department, Department of Hydraulic Resources.

*Numbers in margin indicate pagination in foreign text.

community" level are of great importance, because each vegetal community is, as expressed by Sarukhan (1968), an ecological unit within an ecosystem.

/20

Apart from the intrinsic ecological value of the vegetation maps in the sense that they represent the synthesis of a research, they are the basis of several applications. Those pointed out by Gómez-Pompa and Leon Cázares (1970) will be mentioned.

1) They are the basis for planning forestry, agricultural, and cattle research, since productivity in these fields is closely associated with the different ecological conditions.

2) A knowledge of primary and secondary communities will allow one to calculate the present and the potential productivity of any species. A good example of this is the Committee for Study of Dioscoreas Ecology of the National Institute of Forestal Research.

3) Planning of present and potential usage of soil must be based on ecological investigations, for which vegetation maps are of prime importance.

4) Inventories of renewable natural resources must be based on vegetation maps, since there is not an animal or plant whose distribution is not controlled by some of the factors involved in the distribution of vegetation.

5) Because plants are the best indicators of edaphic variations, vegetation has been used in the cartography of soil and rocks.

6) A knowledge of the different ecological zones of the country by means of vegetation maps will undoubtedly make it possible to plan in a sensible way a network of biological reserves, an urgent necessity in our country.

Several techniques and methods have been used to solve the problem of vegetation mapping within the Flora de Veracruz program - for example, those proposed by Gómez-Pompa, et al. (1964), Gómez-Pompa and Leon Cázares (1970), Kucher (1965), Miranda et al. (1967), Pérez Gímenez (1970), Sousa (1964), etc.

Other parameters closely related to vegetation have also been utilized, since according to Gómez-Pompa et al. (1964), and Cuanalo (1966), the data correlation between climate, soil, topography, geology, and vegetation is very important, and it is well-known that vegetation is an excellent indicator of atmospheric changes. In this respect,

Gomez-Pompa and Leon Cazarez (1970) state that "it is so pervasive that in regions where climate is an important factor, it can be seen that a vegetation map corresponds to a soil map."

At present, remote perception techniques are being utilized with special emphasis on the information provided by the Landsat I and II satellites, because experience from other parts of the earth indicates the possibility of performing this in a much shorter time and at a lower cost than using conventional methods. It has been calculated at the Department of Hydraulic Resources that by using its computer, the total cost, including computer time, materials, and manpower, is \$0.19 per square kilometer.

The objective of this study is to evaluate the degree of accuracy obtainable from this technique of ecological research.

It seems evident, according to the authors' experience, that this technique offers great possibilities. It is, however, necessary to analyze the information provided by the satellite by an interdisciplinary team, using equipment and resources from various institutions. For this reason, the Research Institute of Biotic Resources, the Department of Hydraulic Resources, and the Biology Institute of the UNAM have collaborated in this work, a pilot study of vegetation on the arid zone of Veracruz, and part of Puebla, by means of images from the Landsat I satellite.

A first stage was performed at the Houston Space Center, Texas, where some tests were performed to demonstrate the usefulness of remote perception techniques in the study of tropical vegetation (Soto, et al.) 1975-1976). It was then proposed to carry on a second stage in a more restricted zone, which could provide a basis for more detailed and precise studies.

LOCATION AND PHYSIOGRAPHY

The chosen area of study corresponds to a part of the Puebla arid zone and to the arid zone of Veracruz, whose limits are: (Figure 1)

Latitude 19°22'08"	Longitude 97°18'18" lefthand upper point
Latitude 19°20'02"	Longitude 97°13'51" righthand upper point
Latitude 19°10'55"	Longitude 97°21'10" lefthand lower point
Latitude 19°09'28"	Longitude 97°16'37" righthand lower point.

TOPOGRAPHY

This location comprises a big valley with alluvium soil with an altitude between 2,310 and 2,400 meters above sea level. This land is used for agriculture, both irrigated and non-irrigated.

There are many limestone mountains generally on a southwest-northwest direction, the highest about 2,400 to 2,500 meters above sea level (masl), (Ramos Alvarez and Gonzalez Medrano, 1972), (Figure 2).

Several igneous outcrops are also found in the form of stony ground or as volcanic cones with altitudes up to 2,800 masl.

GEOLOGY

In the working area the following ages are represented (Figure 3):

Jurassic superior: limestone sedimentary rocks (Js)

Cretaceous: limestone sedimentary rocks (K1, KM, Kor, Ks)

Tertiary intrusive and extrusive igneous rocks (Igi) and (Ige) of the travertine type (Tb and T.Tb)

Cenozoic: extrusive igneous rocks (Cv and Cvs)

Quaternary: alluvium (Q)

HYDROLOGY

There are three salt water lagoons of volcanic origin: Alchichica, Quecholac and Preciosa. These are not permanent streams, but torrential rains can cause temporary streams which produce very serious erosion.

In the valley, to the northwest of Alchichica lagoon, a shallow salty-water deposit is formed during the rainy season.

CLIMATE

The climate, according to the Koeppen classification, modified by Garcia, is BS, (kw"(w)(i')), that is, the most humid among semi-arid climates, because its P/T is larger than 22.4. The temperature is mild with hot summers and an average of between 12°C and 18°C. The coldest month has temperatures in the range of -3°C and 18°C. The thermal oscillation is small, since the temperature differential between the hottest and the coldest months lies between 5°C and 9°C. Rain occurs

mainly in the summer. The winter rain is less than 5% of the total (Garcia, 1972).

The reasons why this zone was chosen were:

- a) There is information on it at the Flora de Veracruz data bank.
- b) The Flora de Veracruz program also has a study on the flora of the zone.
- c) The structure of vegetation is relatively simple.
- d) Its flora is generally poor.
- e) Its access is easy.

METHODOLOGY

/24

The work was based on the satellite images obtained on January 19 and May 25, 1973; especially the last one.

Computation

To process the information, the Department of Hydraulic Resources SIADIS system (Automatic Interpretation System for Satellite Images) was used. Initially, gray maps were obtained, from which the zones of interest were located. Once the zone of study was defined, training fields were selected to determine the spectral characteristics of the vegetation types of interest. To this end, non-supervised classification, gradient and divergence analyses were used. With the result of these analyses, and based on conventional photo-interpretation and field data, groups were determined as a function of the digitalized information homogeneity. These groups were used to do a preclassification (the name 'preclassified' stems from the fact that it was done in the office).

Subsequently, the preclassified data was correlated with that obtained from the field studies. The results of this correlation were used for the final classification. The final classification shows, in addition to the maps, the area covered by each class of vegetation and the zone limiting coordinates.

Ground Support

Several field trips helped to identify and locate the different groups which appeared on the gray maps, preclassified and classified by the computer.

Besides, plants were collected in the zone. With the information

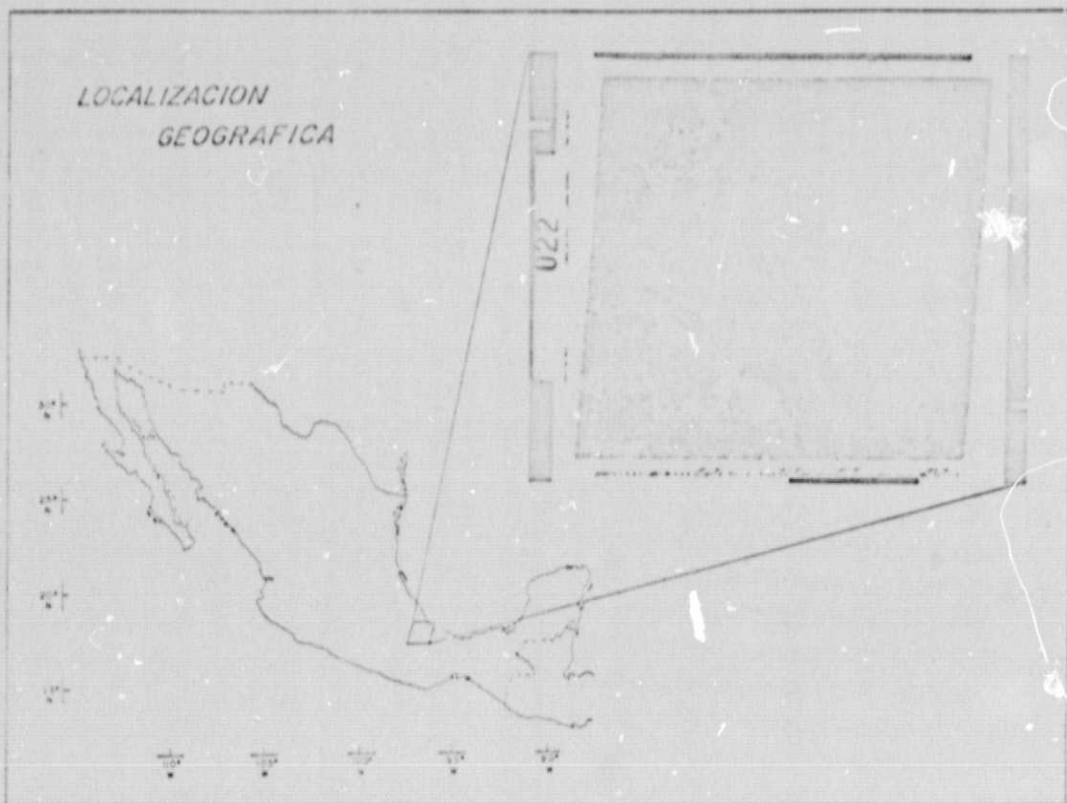


Figure 1: Area location. The upper right projection corresponds to an image from the Landsat satellite.

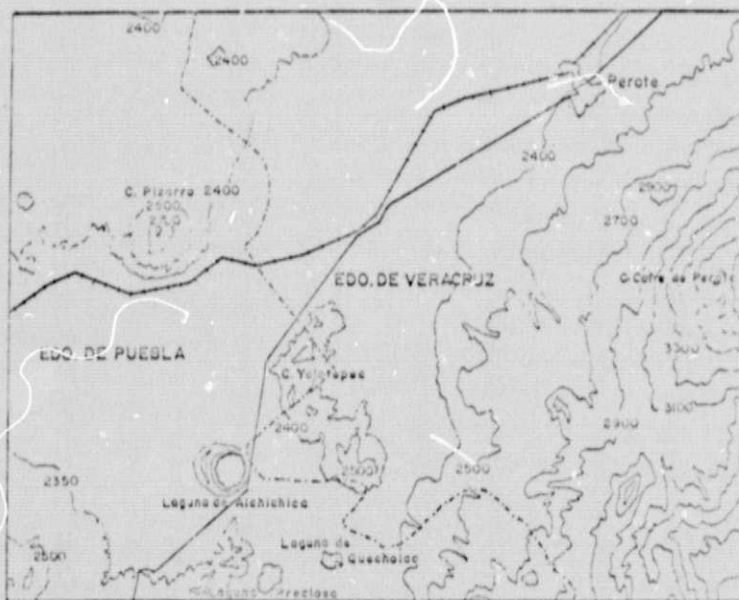
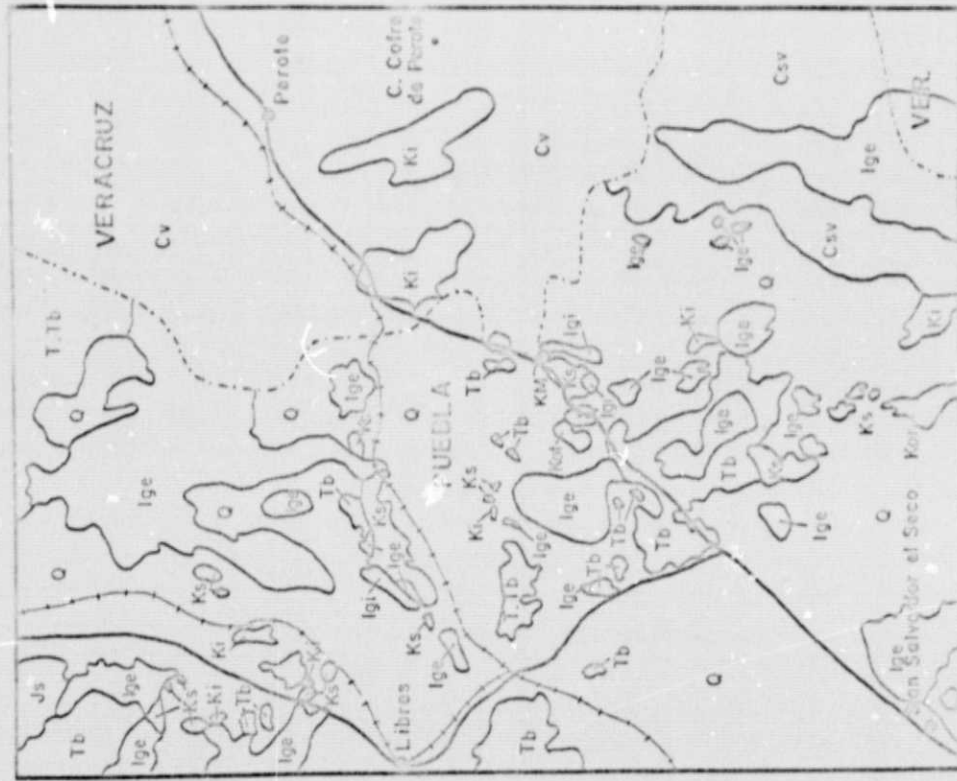


Figure 2: Topographic map from the Topographic Chart of the Defense Department (1968).

ORIGINAL PAGE IS
OF POOR QUALITY



SEDIMENTARY ROCKS

Js Jurassic superior
K1 Cretaceous inferior
KM/Kor Mid-Cretaceous
Ks Cretaceous superior
Q Quaternary

EXTRUSIVE IGNEOUS ROCKS

Cv Cenozoic
Csv Cenozoic superior volcanic
Ige Tertiary
T.T Tertiary (non-identified travertin)
Tb Tertiary (volcanic ashes and travertin)

INTRUSIVE

Igi Tertiary (granite, porphyry, etc.)

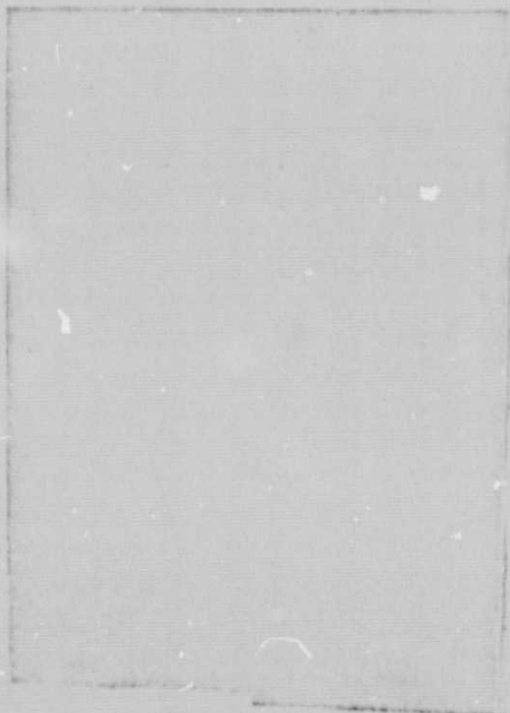
Figure 3: Geological Map from the Geological Chart of the Mexican Republic (Lopez Ramos, 1966).



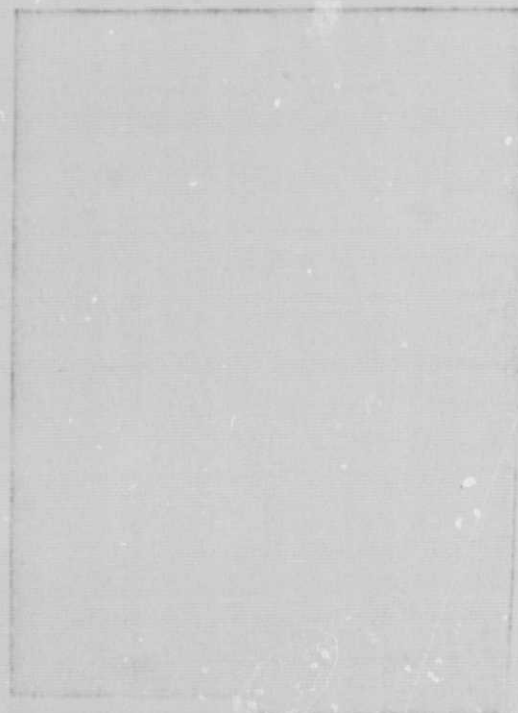
BAND 1



BAND 2



BAND 3



BAND 4

Figure 4: Hand-colored gray maps.

**ORIGINAL PAGE IS
OF POOR QUALITY**